

Dr Martin P. Rey — Astrophysicist

Beecroft Fellow in Cosmology, University of Oxford
Sub-department of Astrophysics, Keble Road, Oxford, OX1 3RH, UK

✉ martin.rey@physics.ox.ac.uk 🌐 <https://martin-rey.github.io> ORCID: 0000-0002-1515-995X

Research Interests

Astrophysics and Cosmology – formation and evolution of galaxies – dynamics and statistics of cosmological structures – nature of dark matter – dwarf galaxies and low-surface brightness systems

Employment

Beecroft fellow in Cosmology <i>University of Oxford, United Kingdom</i>	Sep 2021 - Ongoing
Postdoctoral research fellow <i>Lund University, Sweden</i>	Nov 2019 - Sep 2021

Education

Ph.D in Astrophysics <i>University College London, United Kingdom</i>	Oct 2016 - Oct 2019
MSc in Aerospace engineering <i>ISAE Supaéro, France</i>	Sep 2012 - Sep 2016
MSc in Physics with distinction <i>Imperial College London, United Kingdom</i>	Sep 2014 - Sep 2015

Publications

Summary and bibliometry: 18 peer-reviewed publications (8 as leading author), 5 further submitted. 488 total citations, h-index = 12, g-index = 19, m-index=2. 144 citations as leading author, h-index = 6, 4 papers with ≥ 20 citations. Source ADS, ORCID: 0000-0002-1515-995X, June 5th 2023.

Highlighted works – see below for complete list:

- **Rey et al.** 2023, MNRAS, 521, 995 – *most recent work showing how Milky Way stars traditionally linked to our Galaxy's last major merger can also originate from multiple ancient interactions.*
- **Rey et al.** 2020, MNRAS, 497, 1508 – *results covered by general media explaining for the first time the puzzling observations of extremely low-mass, yet star-forming dwarf galaxies.*
- **Rey et al.** 2019, ApJL, 886, L3 – *most cited first-author paper quantifying the scatter in the stellar masses of faint dwarf galaxies, a key input for accurate dark matter and galaxy formation constraints.*

Grants and awards

Prizes and grants

- Beecroft Fellowship in Cosmology, 3-year independent personal grant (\approx £200,000)
- Christopher Skinner Prize for outstanding PhD research (£100)
- Travel awards obtained after panel review from IAU, CASPEN and RAS (\approx 3500\$)

Computing Time:

- PI: 1.4M CPUh on Sweden SNIC, Co-PI: 53M CPUh on UK DIRAC
- Co-I: \geq 250M CPUh on EU-PRACE, UK-DIRAC, NSF-Frontera

Public speaking

11 invited seminars and colloquiums (last in Caltech, Stockholm and Cardiff), 2 general-public lectures in Sweden and France, >10 presentations at international conferences, workshops and group meetings in the last two years.

Supervision, teaching and mentoring

Student supervision: 4 student projects since 2018 (3 BSc, 1 MSc). All projects successfully defended on time, one leading to a refereed publication (Prgomet, Rey et al. 2022). Formal examiner of 2 thesis.

Teaching: Regular activity since 2017, from 1st-year to graduate courses. 3h as a Lecturer, ≥ 50 h as teaching assistant, ≥ 20 h of marking. Detailed list of courses available below.

Mentoring and project management:

- Active in mentoring programs since 2012, for incoming fellow post-docs in Oxford (2021-), incoming PhD students at UCL (2017-2019) and foreign students arriving in France (2012-2016).
- Student project manager of a scientific satellite mission (2013-2016), leading a ≥ 40 -student team to design, build and launch a spacecraft studying atmospheric re-entry.

Media and outreach

General media: Rey et al. (2020) featured in ScienceNews and Forskning and Framsteg, Rey and Starckenburg (2022) in AstroBites. 4 media appearances, most recently in Populär Astronomi.

Outreach: Regular activity since 2016, two invited public lectures in France and Sweden. Organiser and contributor to ≥ 10 outreach workshops, events and festivals.

Professional and communal activities

Reviewing and panels:

- Peer-reviewing since 2018 for MNRAS and ApJ (4 papers in the last year).
- Part of review panels since 2020 (LSST Enable Science grants, PhD student admissions in Lund, summer interns in Oxford).

Public software: see my Github for detailed contributions

- Part of the main development and maintenance team of the public genetiC software
- Regular contributor to public astrophysics softwares Ramses, Pynbody, Tangos.

Event organization:

- SOC/LOC for RUM 2023, Wetton Workshop 2022, Compact Objects for All 2020
- Organizer of Oxford's Galaxy Evolution seminars (2022-), UCL Journal Club (2018-2020)

References

Prof. Andrew Pontzen, University College London
Department of Physics and Astronomy
Gower Street, London, WC1E 6BT, UK
a.pontzen@ucl.ac.uk, +442035495833

Prof. Pedro Ferreira, University of Oxford
Sub-department of Astrophysics
DWB, Keble Road, OX1 3RH Oxford, UK
pedro.ferreira@physics.ox.ac.uk, +44186573366

Dr. Oscar Agertz, Lund University
Division of Astrophysics
Sölvegatan 27, 22100 Lund, Sweden
oscar.agertz@astro.lu.se, +46462221576

Prof. Justin I. Read, University of Surrey
Department of Physics
Guildford, Surrey GU2 7XH, UK
j.read@surrey.ac.uk, +441483686814

List of publications – Martin P. Rey

Summary: 18 peer-reviewed publications (8 as leading author), 5 further submitted. 488 total citations, h-index = 12, g-index = 19, m-index=2. 144 citations as leading author, h-index = 6, 4 papers with ≥ 20 citations. Source ADS, ORCID: 0000-0002-1515-995X, June 5th 2023.

Publications as lead author

1. **Martin P. Rey**, Harley B. Katz, Alex J. Cameron, Julien Devriendt, Adrienne Slyz; Boosting galactic outflows with enhanced resolution; Submitted to Monthly Notices of the Royal Astronomical Society, arXiv:2302.08521
2. **Martin P. Rey**, Oscar Agertz, Tjitske K. Starckenburg, Florent Renaud, Gandhali D. Joshi, Andrew Pontzen, Nicolas F. Martin, Diane K. Feuillet, Justin I Read; Vintergatan-GM: the cosmological imprints of early mergers on Milky-Way-mass galaxies; Monthly Notices of the Royal Astronomical Society, Volume 521, Issue 1, May 2023, Pages 905-1112
3. **Martin P. Rey**, Andrew Pontzen, Oscar Agertz, Matthew D. A. Orkney, Justin I. Read, Stacy D. Kim, Payel Das; EDGE: What shapes the relationship between stellar and HI observables in faint dwarfs?, Monthly Notices of the Royal Astronomical Society, Volume 511, Issue 4, Pages 5672-5681
4. **Martin P. Rey**, Tjitske K. Starckenburg; How cosmological merger histories shape stellar haloes, Monthly Notices of the Royal Astronomical Society, Volume 510, Issue 3, March 2022, Pages 4208-4244
5. **Martin P. Rey**, Andrew Pontzen, Oscar Agertz, Matthew Orkney, Justin I. Read, Joakim Rosdahl; EDGE: from quiescent to gas-rich to star-forming low-mass dwarf galaxies, Monthly Notices of the Royal Astronomical Society, Volume 497, Issue 2, August 2020, Pages 1508-1520
6. **Martin P. Rey**, Andrew Pontzen, Oscar Agertz, Matthew Orkney, Justin I. Read, Amélie Saintonge, Christian Pedersen; EDGE: the origin of scatter in ultra-faint dwarf stellar masses and surface brightnesses, The Astrophysical Journal Letters, Volume 886, Issue 1, November 2019, L3
7. **Martin P. Rey**, Andrew Pontzen, Amélie Saintonge; Sensitivity of dark matter haloes to their accretion histories, Monthly Notices of the Royal Astronomical Society, Volume 485, Issue 2, May 2019, Pages 1906-1915
8. **Martin P. Rey**, Andrew Pontzen; Quadratic genetic modifications: a streamlined route to cosmological simulations with controlled merger history, Monthly Notices of the Royal Astronomical Society, Volume 474, Issue 1, February 2018, Pages 45–54

Publications as major contributor or supervisor

1. Alex J. Cameron, Harley Katz, **Martin P. Rey**, Aayush Saxena; Nitrogen enhancements 440 Myr after the Big Bang: super-solar N/O, a tidal disruption event or a dense stellar cluster in GN-z11?, Monthly Notices of the Royal Astronomical Society, May 2023
Contribution: Conceptualisation, co-writing original draft (discussion sections).

2. Mateo Prgommet, **Martin P. Rey**, Eric P. Andersson, Alvaro Segovia Otero, Oscar Agertz, Florent Renaud, Andrew Pontzen, Justin I. Read; EDGE: The sensitivity of ultra-faint dwarfs to a metallicity-dependent initial mass function, *Monthly Notices of the Royal Astronomical Society*, Volume 513, Issue 2, June 2022, Pages 2326-2334
Contribution: Conceptualisation, student supervision, co-writing original draft.
3. Matthew D. A. Orkney, Justin I. Read, **Martin P. Rey**, Imran Nasim, Andrew Pontzen, Oscar Agertz, Stacy Y. Kim, Maxime Delorme, Walter Dehnen; EDGE: Two routes to dark matter core formation in ultra-faint dwarfs, *Monthly Notices of the Royal Astronomical Society*, Volume 504, Issue 3, July 2021, Pages 3509-3522
Contribution: Generating initial conditions, running simulation suite, draft editing.
4. Andrew Pontzen, **Martin P. Rey**, Corentin Cadiou, Oscar Agertz, Romain Teyssier, Justin I. Read, Matthew D. A. Orkney; EDGE: A new approach to suppressing numerical diffusion in adaptive mesh simulations of galaxy formation, *Monthly Notices of the Royal Astronomical Society*, Volume 501, Issue 2, February 2021, Pages 1755-1765
Contribution: Conceptualisation, generating initial conditions, running simulation suite, draft editing.
5. Stopyra, Andrew Pontzen, Hiranya Peiris, Nina Roth, **Martin P. Rey**; GenetIC: a new initial condition generator to support genetically modified zoom simulations, *The Astrophysical Journal Supplement Series*, Volume 252, Issue 2, February 2021, Pages 28
Contribution: Method and code development, refactoring and maintenance for public release, draft editing.

Publications as collaborator

1. Charles L. Steinhardt, Albert Snappen, Thorbjørn Clausen, Harley Katz, **Martin P. Rey**, Jonas Stahlschmidt; The Highest-Redshift Balmer Breaks as a Test of Λ CDM, submitted to the *Astrophysical Journal Letters*, arXiv:2305.15459
Contribution: Analysing simulations, co-writing original draft.
2. Matthew D. A. Orkney, Ethan Taylor, Justin I. Read, **Martin P. Rey**, Andrew Pontzen, Oscar Agertz, Stacy Y. Kim, Maxime Delorme; EDGE: The shape of dark matter haloes in the faintest galaxies, submitted to *Monthly Notices of the Royal Society*, arXiv:2302.12818
Contribution: Generating initial conditions, running simulation suite, draft editing.
3. Sam Geen, Poojan Agrawal, Paul A. Crowther, B.W. Keller, Alex de Koter, Zsolt Keszthelyi, Freeke van de Voort, Ahmad A. Ali, Frank Backs, Lars Bonne, Vittoria Brugaletta, Annelotte Derkink, Sylvia Ekström, Yvonne A. Fichtner, Luca Grassitelli, Ylva Götberg, Erin R. Higgins, Eva Laplace, Kong You Liow, Marta Lorenzo, Anna F. McLeod, Georges Meynet, Megan Newsome, G. André Oliva, Varsha Ramachandran, **Martin P. Rey**, Steven Rieder, Emilio Romano-Díaz, Gautham Sabhahit, Andreas A.C. Sander, Rafia Sarwar, Hanno Stinshoff, Mitchel Stoop, Dorottya Szécsi, Maxime Trebitsch, Jorick S. Vink, Ethan Winch; Bringing Stellar Evolution & Feedback Together: Summary of proposals from the Lorentz Center Workshop, *Publications of the Astronomical Society of the Pacific*, Volume 135, Issue 1044, February 2023
Contribution: Lead of 'Ionizing radiation' section.

4. Harley Katz, Shenghua Liu, Taysun Kimm, **Martin P. Rey**, Eric P. Andersson, Alex J. Cameron, Francisco Rodriguez-Montero, Oscar Agertz, Julien Devriendt, Adrienne Slys; PRISM: A non-equilibrium, multiphase interstellar medium model for Ramses-RTZ, submitted to Monthly Notices of the Royal Astronomical Society, arXiv:2211.04626
Contribution: Conceptualisation, scientific analysis and draft editing.
5. Alex J. Cameron, Harley Katz, **Martin P. Rey**; A novel approach to correcting T_e -based mass-metallicity relations, Monthly Notices of the Royal Astronomical Society Letters, Volume 552, Issue 1, June 2023, Pages L89-L94
Contribution: Conceptualisation, scientific analysis and draft editing.
6. Matthew D. A. Orkney, Justin I. Read, Oscar Agertz, Andrew Pontzen, **Martin P. Rey**, Alex Goater, Ethan Taylor, Stacy Y. Kim, Maxime Delorme; EDGE: The puzzling ellipticity of Eridanus II star cluster and its implications for dark matter at the heart of an ultra-faint dwarf, Monthly Notices of the Royal Astronomical Society, Volume 515, Issue 1, September 2022, Pages 185-200
Contribution: Generating initial conditions, running simulation suite, scientific analysis and draft editing.
7. Oscar Agertz, Florent Renaud, Sofia Feltzing, Justin I. Read, Nils Ryde, Eric P. Andersson, **Martin P. Rey**, Thomas Bensby, Diane K. Feuillet; VINTERGATAN I: the origins of chemically, kinematically and structurally distinct discs in a simulated Milky-Way-mass galaxy, Monthly Notices of the Royal Astronomical Society, Volume 503, Issue 4, June 2021, Pages 5826-5845
Contribution: Scientific analysis and draft editing.
8. Florent Renaud, Oscar Agertz, Justin I. Read, Nils Ryde, Eric P. Andersson, Thomas Bensby, **Martin P. Rey**, Diane K. Feuillet; VINTERGATAN II: the history of the Milky-Way told by its mergers, Monthly Notices of the Royal Astronomical Society, Volume 503, Issue 4, June 2021, Pages 5846-5867
Contribution: Scientific analysis and draft editing.
9. Florent Renaud, Oscar Agertz, Eric P. Andersson, Justin I. Read, Nils Ryde, Thomas Bensby, **Martin P. Rey**, Diane K. Feuillet; VINTERGATAN III: how to reset the metallicity of the Milky Way, Monthly Notices of the Royal Astronomical Society, Volume 503, Issue 4, June 2021, Pages 5868-5876
Contribution: Draft editing.
10. Oscar Agertz, Andrew Pontzen, Justin I. Read, **Martin P. Rey**, Matthew Orkney, Joakim Rosdahl, Romain Teyssier, Robbert Verbeke, Michael Kretschmer, Sarah Nickerson; EDGE: the mass-metallicity relation as a critical test of galaxy formation physics, Monthly Notices of the Royal Astronomical Society, Volume 491, Issue 2, January 2020, Pages 1656-1672
Contribution: Scientific analysis and draft editing.

Other publications

1. Hypatia colloquium proceedings: From quenched to gas-rich to star-forming: the diversity of faint dwarf galaxies
2. PhD Thesis: Genetically modified galaxies: performing controlled experiments in cosmological galaxy formation simulations
3. Public software GenetIC (cosmological initial condition generator): Version 1.4 and previous
Contribution: Main development and maintenance team.
4. Public software Tangos (analysis package): Version 1.7.0 and previous
Contribution: New features, bug fixing.

5. Public software Pynbody (analysis package): Version 1.3.1 and previous
Contribution: New features, bug fixing.

Public speaking – Martin P. Rey

Summary: 11 invited seminars and colloquiums (last in Caltech, Stockholm and Cardiff), 2 general-public lectures in Sweden and France, >10 presentations at international conferences, workshops and group meetings in the last two years.

2023 Apr: Contributed talk, Ramses User Meeting, Oxford

2023 Mar: Contributed talk, Galaxy Formation and Evolution in the Data Science Era, KITP

2023 Mar: **Invited colloquium**, TAPIR, CalTech

2023 Feb: **Invited colloquium**, University of Stockholm

2023 Feb: Cosmology group meeting presentation, Imperial College London

2023 Feb: **Invited colloquium**, Cardiff University

2023 Jan: Early-career colloquium, University of Oxford

2022 Dec: **Invited colloquium**, ASTRON, Groningen

2022 Sep: Contributed talk, WMAG 2022

2022 May: Tri-state seminar, CCA, Flatiron Institute University

2022 May: **Invited colloquium**, New York University

2022 May: **Invited Källén Seminar**, Lund Observatory

2022 Apr: **Invited Talk**, Bringing stellar evolution and feedback together, Lorentz Center

2021 Dec: **Invited colloquium**, Centre de Recherche d'Astrophysique de Lyon

2021 Nov: Invited participant, Astrophysical Windows on Dark Matter Workshop, London

2021 Oct: Massive stars and stellar evolution group meeting presentation, Anton Pannekoek

2021 Oct: Galaxy Evolution Seminar, University of Oxford

2021 Oct: Comp theory Group Meeting presentation, ICRAR

2021 Oct: **Invited colloquium**, Observatoire de Strasbourg

2021 Sep: Contributed talk, Ramses User Meeting, Online

2021 Jun: Contributed talk, EAS 2021: the outer reaches of galaxies, Leiden

2021 Jun: Astro Coffee presentation, Princeton

2021 Apr: **Invited Rydberg Seminar**, Physics Institute, Lund

2021 Mar: Invited participant, Bringing stellar evolution and feedback together, Lorentz Center

2021 Mar: **Hypatia Colloquium**, ESO Garching

2021 Mar: **General public lecture**, Staffanstorp Rotary

2020 Aug: Contributed talk, The Local Group assembly and evolution, Baltimore

2020 Jun: Contributed talk, News from the dark workshop, Strasbourg

2020 Feb: **Invited colloquium**, Lund University

2019 Aug: Contributed talk, Small galaxies, cosmic origins, Durham

2019 Jul: Contributed poster, The realm of the low surface brightness universe, Tenerife

2019 Jun: Contributed poster, Feedback and its role in galaxy formation, Spetses

2019 May: Blackboard presentation, Lund University

2018 Oct: Galaxy formation seminar, Rutgers University

2018 Oct: Lunch seminar, Yale University

2018 Oct: Cosmology seminar, Flatiron Institute

2018 Oct: PhD presentations, University College London

2018 Sep: Contributed poster, The role of feedback in galaxy formation, Potsdam
2018 Jul: **General public lecture**, Astr'auvergne festival, Clermont-Ferrand

2017 Sep: Contributed talk, Frontiers of Astrophysical Modelling, Leuven
2017 Sep: Contributed talk, Ramses User meeting, Nice
2017 Jun: Blackboard presentation, Imperial College London

Teaching and student supervision – Martin P. Rey

Resume: Regular activity since 2017, from 1st-year to graduate courses. 3h as a Lecturer, ≥ 50 h as teaching assistant, ≥ 20 h of marking.

Courses taught:

1. Lecturer, Topics in Theoretical Astrophysics, Graduate lectures for PhD students, Lund University, 2021, 3h
2. Teaching Assistant, Stellar Structure and Evolution, ASTM25, 1st year Master Course, Lund University, 2020, 2x2h
3. Teaching Assistant, Scientific programming in Java, PHAS3459, 3rd year Bachelor course, University College London, 2018, 10x3h
4. Lecturer and organizer, Scientific programming with Git, Graduate workshop, University College London, 2018, 7h
5. Teaching Assistant and Marker, Mathematical Methods for Physics, PHAS1246, 1st year Bachelor course, University College London, 2018, 2x10h
6. Teaching Assistant and Marker, Astrophysics and Quantum Physics, PHAS1423, 1st year Bachelor course, University College London, 2017, 2x10h

Student supervision and examination: 4 student projects since 2018 (3 BSc, 1 MSc). All projects successfully defended on time, one leading to a refereed publication (Prgomet, Rey et al. 2022). Formal examiner of 2 thesis.

1. Laura Meissner, undergraduate project, main supervisor, Oxford 2022
2. Mateo Prgomet, co-supervisor of MSc project and main supervisor of post-MSc project, Lund 2021
3. Tamina Lund, Bachelor Thesis obtained with honours, main supervisor, Lund 2020
4. Elise Darragh-Ford: undergraduate project, main supervisor, 2018
5. Jesper Nielsen, MSc thesis examiner, 2021, Lund University
6. Viktor Jónsson, BSc thesis examiner, 2021, Lund University

Press and outreach activities – Martin P. Rey

Summary: 1 press release, 4 contributions to press articles and radio interviews, 2 general public lectures, ≥ 10 contributions to outreach events and workshops.

Press coverage of scientific results:

1. Rey and Starckenburg 2022 in AstroBites.
2. Press release following the results of Rey et al. 2020, "How dwarf galaxies form their stars", in Forskning and Framsteg and Science News.

Media contributions and appearances:

1. In Populär Astronomi following their coverage of ESO Hypatia colloquium, 2021
2. In Forskning and Framsteg following their coverage of SDSS results, 2021
3. Written contribution to All About Space Magazine, 2020
4. Radio interview on Radio Arverne, 2019

Outreach events:

1. Cosmology and Galaxies stall leader and demonstrator for Into the Cosmos, 2023
2. Co-organizer of Marie Curious workshops, 2021–2022
3. Demonstrator for UCL opening day of the KLB building, 2019
4. Co-organiser of astronomy summer schools in festival Astr'Auvergne, 2018
5. Demonstrator for Your Universe festival Your Universe, 2018
6. Demonstrator for astronomy discovery day at the French high school in London, 2018